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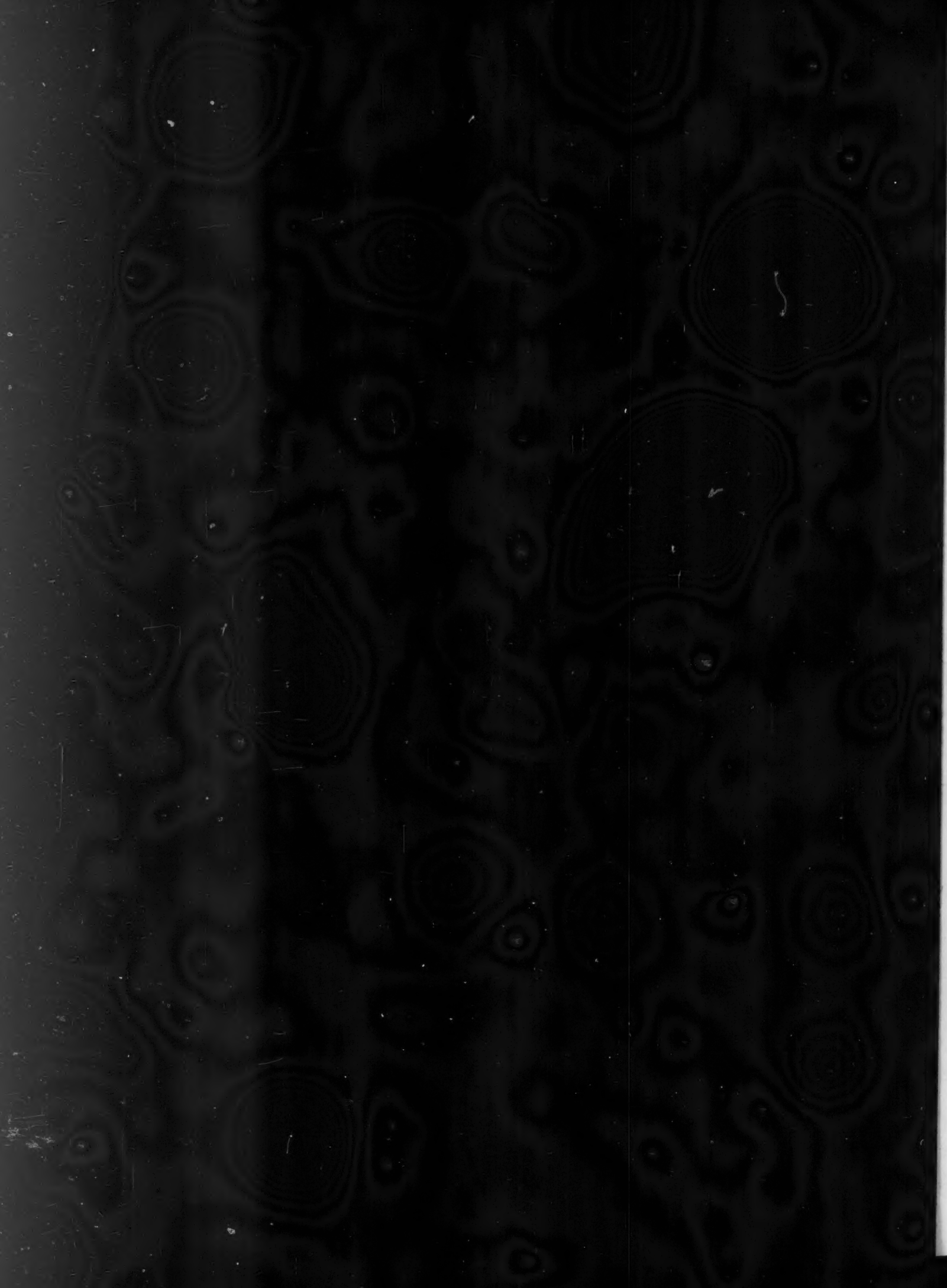

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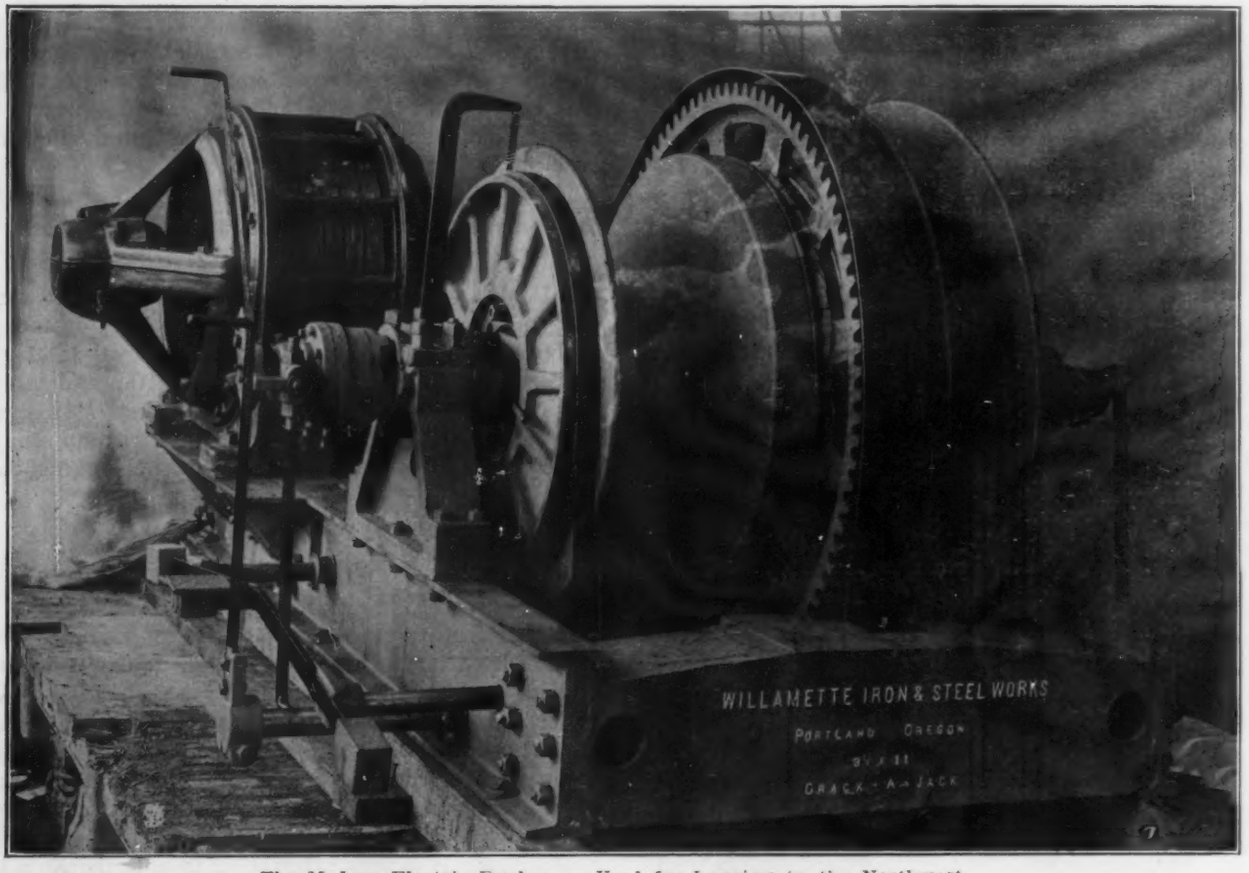
ELECTRIC VS. STEAM LOGGING

BY W. D. PEASLEE.

(This excellent paper gives much valuable information relative to the comparative costs of the electric and steam operated donkeys as used in the great logging industries of the northwest. The author is a consulting engineer at Portland, Oregon, and presented this paper before the recent Pacific Coast Logging Congress at Portland.—The Editor.)

The final answer to the question as to which logging machine is most suited for a particular duty is made up of two parts. The first and most important is represented by the dollar mark, and is a comparison of all the advantages and disadvantages that can be expressed in terms of money, met with in doing the work with each machine. The second consists of more intangible advantages accruing from the operation of one or the other which cannot be readily expressed in dollars and cents.

In this paper an endeavor will be made to compare the electric and steam donkeys on as reasonable a basis as possible with especial attention to the question of cost and brief mention of the factors that are not readily evaluated when they bear on the question.

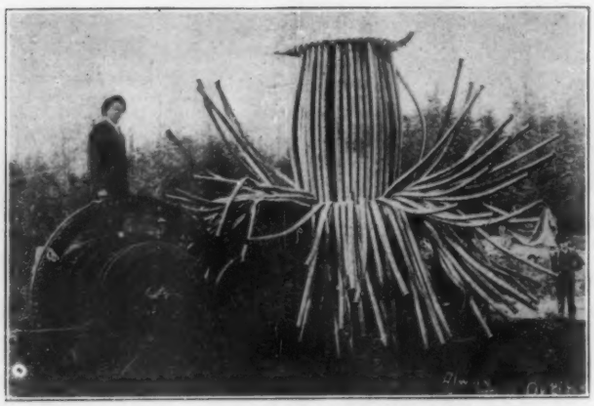


The Modern Electric Donkey as Used for Logging in the Northwest.

The cost of logging, or any other operation, is made up of operation and fixed cost as follows:

Electric Operation.

1. Labor.
2. Supplies including fuel, water, oil, waste, etc.



A Sad Experience in Steam Logging Not Encountered Under the Electrical Method.

Interest on the investment required.
Maintenance.
Depreciation.
Taxes and insurance.

These are readily determined and expressed in dollars and cents. In a comparison of the two machines however, the following items must also be taken into consideration.

Production. (Can be saved.)
Fire damage. (Can be approximated roughly.)
Safety. (Hard to value.)
Special advantages (Hard to value.)

The question of operating costs has been rather fully dealt with in a previous paper and will be reviewed here, though for the complete discussion those interested are referred to that article. (Timberman, June, 1916, page 46).

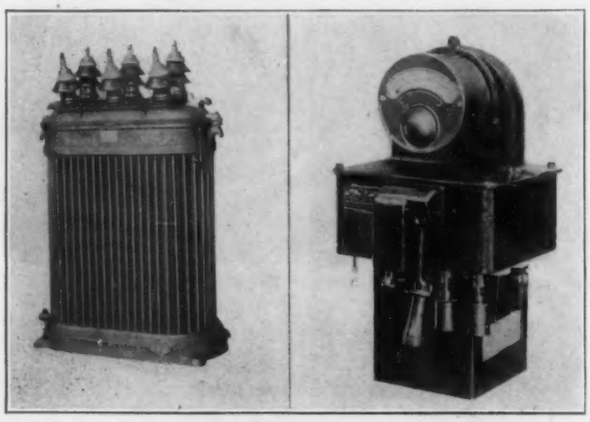
It is generally conceded that the logging operation proper amounts to about thirty-five to fifty per cent of the cost of logs at the mill and the cost of use of the donkey is a large factor in this cost.

The terms "cost of use" has been adopted here as the expression "cost of logging" includes such labor costs as felling, wire rope costs, and other items that are not affected by the particular type of donkey employed in ground yarding.

Steam Operation.

The items that affect the cost of operation of the steam donkey may be grouped as follows:

1. Fuel costs.



The Electric Transformer Used for Logging and the Instruments for Control.

This includes the actual cost of the fuel used. In the case of wood burning donkeys it has been found that the wood used is usually taken from pretty good logs because it splits easy and so is usually undervalued. The logger has to get the steam.

2. Labor costs.

This includes the wages of the fireman, wood bucks, and engineer as well as those of the wood cutters and the proper proportion of the wages of the night watch. Also the cost of labor for firing up early to get steam up at starting time.

3. Water.

In most cases this has been found to be a very large factor of expense as water was pumped considerable distances.

4. Character of ground and length of haul.

There is of course wide variance in these factors in the different localities and as a result we find the operation costs of the donkey varying over wide limits as indicated in table I. It will be observed there that for wood-burning donkeys the cost varies from $16.80 to $34.95 per day and for oil burning from $12.90 to $17.00 per day.

For this reason comparative studies of different camps are very apt to be misleading and, since few camps have electric donkeys in operation it would seem impossible to arrive at a fair statement of the comparative cost of operation of steam and electric donkeys. Fortunately, however, data available from the tests of the few electric donkeys now in operation make it possible to arrive at a very close figure to the cost of doing the work done by any steam donkey with an electric machine.

In the first place the following changes are made in the items mentioned as affecting operating costs.

1. Fuel.

For this item we find power cost substituted and due to the uniform conditions as to fuel costs at a power plant and other factors mentioned later this cost per horsepower hour will vary little, and for the purpose of this discussion will be taken at a figure that is known to be possible either with purchased power or with power generated by the logging company.

2. Water.

Eliminated completely.

3. Character of ground and length of haul.

This feature can be taken care of for each comparison by a careful study of the particular conditions of haul and the power taken by an electric donkey under hauls as near the same as possible and averaging the results. This will give comparative figures for the particular case under consideration but the ratio so secured must not be used to cover all cases as a general comparison made from specific cases is often misleading. It is very interesting to note that in a few cases where it has been possible to obtain actual comparative tests of steam and electric machines the above method of comparison has given results very much in agreement with the test figures.

To the logger, to whom the electric donkey is a very new thing and so to be regarded with con-

siderable suspicion and distrust it may be said that the electric logging donkey is to the electrical engineer merely a very special form of the common hoist, which has been operated successfully by electricity for some time, and when studied as such and applied with a large proportion of common sense to the actual conditions that must be met in logging practice it is not at all difficult to predict what it will do and how much it will cost to do it.

Considerable data is available in the form given in table II from which we make a detail study of the work being done by a steam donkey and determine closely the cost of doing the same work with an electric machine. By a careful analysis of a large amount of data such as is given in this table the cost of doing with an electric donkey the same work as has been done by the steam equipments has been computed and tabulated in table III. In the case of the "H," company the first electric cost is the result of an actual comparative test and the second electrical cost figure given was computed by the method above outlined.

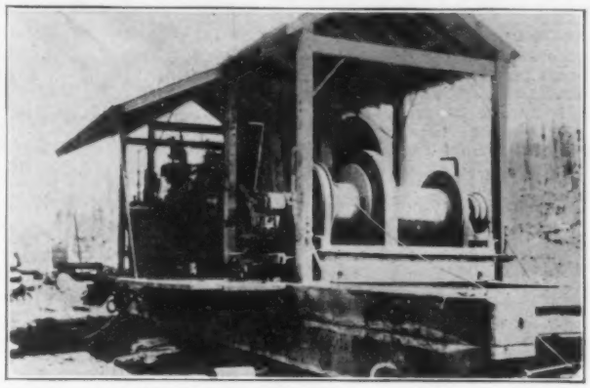
These figures are based on a power cost of 1.5 cents per kilowatt hour (1.12 cents per horsepower hour) which figure can in some cases where the power is generated near the point of use or is purchased from power companies whose lines run near the donkeys, be considerably reduced. One power company has offered to run short lines and sell power at the donkey at a price that with ordinary use will cost 1.33 cents per kilowatt hour (0.99 cents per horsepower hour) and another offered power for a combined mill and logging load, delivered at the mill substation at a price that with the average load factor of such a load wound amount to three-quarters of a cent per kilowatt hour, which when the maintenance and fixed costs of the transmission line were considered, gave for that particular case a power cost of 1.22 cents per kilowatt hour (0.905 cents per horsepower hour). In view of these facts the use of the figure of 1.5 cents per kilowatt hour (1.22 cents per horsepower hour) is not unreasonable. Taking the figures secured by Mr. Peed of the Hammond Lumber Company, Samoa, Cal., it would show an electric power cost of less than $6 per day at time of operation.

An investigation of the data available shows very clearly that as shown in tables I and III as far as operating costs are concerned the electric donkey will do the same work cheaper than the steam donkey either with wood or oil burning machines.

Fixed Charges.

The total cost of use of either machine however includes as was previously outlined, what are commonly termed the fixed charges and we will now proceed to an investigation of the effect of these costs on the comparison.

The figures upon which the following costs are based are derived from estimates and bids that were secured in the course of investigations made by the writer as to the advisability of electrifying the logging equipment in two camps of the Northwest. The prices are for machines laid down at the logging camp or nearest rail connection and while they are not at the present time reliable as up-to-date quotations, they represent very closely the comparative cost of the two machines, though differences in freight charges and the element of competitive bidding would be likely to alter somewhat the relative costs of similar machines if purchased at the present time. The difference would



The Portable Electric Donkey as Installed in the Logging Area.

be small and would have to be greatly in favor of the steam equipment to materially change the relative final comparative results.

Interest on each investment will be assumed at six per cent. It will also be assumed that the company will generate its own power and that it can do so at a cost of 1.5 cents per kilowatt hour at the donkey, burning mill refuse under the power plant boilers. The saw mill will be electrically driven and 35 per cent of the charges of the power house and building will be applied to the logging operation, the rest being properly chargeable to the mill. These and all the charges on the transmission line are considered in the cost of power at the donkey. The charges on the transformers and logging engine investment will be fully applied to the logging operation.

If power is purchased at 1 cent per kilowatt hour at the substation and distributed, the conditions will be about the same as this and will just about give 1.5 cents per kilowatt hour at the donkey.

The following summary of costs per donkey is based on an installation of five machines.

	Investment per Donkey.
Building 35 per cent of proportionate building cost	$ 1,050.00
Power station on same basis	5,330.00
Transmission line	3,200.00
Step down transformers logging donkeys and cables	6,550.00
Total investment per donkey	$16,130.00

The fixed charges on the building, power station, and transmission line are considered in the price of 1.5 cents per kilowatt hour at the donkey. It will cost less than 1 cent at the power house switchboard. Therefore the total investment on which charges are to be considered is that in the donkey, step down transformers, and armored cables. The fixed charges therefore, are:

Interest 6 per cent	$ 393.00
Maintenance 5 per cent	327.50
Depreciation 5 per cent	327.50
Taxes and insurance 3 per cent	196.50
Total fixed charges	$1,244.50
Changes in transmission line due to changing location of donkey, this means moving donkey 3 miles per year	600.00
Operation 300 days at $13.05 per day (Company G, Table III)	3,915.00
Contingencies	200.00
Total cost of use	$5,859.50

In this time it will handle on a basis of the same production as the steam donkey with which it is to be compared, on a basis of 96,000 ft. B. M. per day, which is handled at a cost of 20.35 cents per 1000 ft. B. M.

For steam donkey operation we have the following data:

One steam donkey 11x13 complete	$5,230.00
Operation 300 days at $17 per day, oil burning	5,100.00
Maintenance from records	463.70
Depreciation 10 per cent	523.00
Repairs from records	193.10
Interest at 6 per cent	313.80
Taxes and insurance 3 per cent	156.90
Total cost of use	$6,750.50

This is a cost per 1000 ft. B. M. of $.234.

It is shown by tests and the operation of the few electric donkeys that are now in use that the electric donkey will handle from 30 per cent to 50 per cent more logs in a given time than the steam donkey it is designed to replace. To be liberal we will take the figure at 25 per cent and see how the two machines compare on this basis.

The reason for this increased production have been mentioned in the papers given before the Logging Congress and so no discussion is offered here of this feature.

The capital invested does not change, due to this increased production, and the cost of operation changes only in the power item as the cost of labor is the same. So we have for the cost of use, under the various conditions assumed:

	Cost per year.	Cost 1000 ft.
Steam	$6,750.00	$.234
Electric, same work as steam	5,859.50	.2035
Electric, working at maximum rate	6,149.50	.1705

Thus simply by virtue of its greater ability to maintain a high rate of doing work the electric donkey has taken 3.3 cents per 1000 ft. B. M. from the costs of logs at the mill and decreased the cost over steam 6.35 cents per 1000 ft. B. M.

Thus on a basis of readily valued factors the electric donkey makes a reduction in the cost of logs at the mill of a little less than 1 per cent. In dollars per year this figure becomes more impressive as it means

$.0635 \times 28800 \times 1.25 = $2285.00.

which is 6 per cent interest on $38,500.

This increased production however results in another saving; that is in the labor cost per 1000 ft. B. M. As the production is increased 25 per cent without increasing the labor in the woods, this labor cost will be reduced 20 per cent. This item must be considered for each camp as a problem in itself easily solved when the number of men working from the donkey are known. In the camp under discussion this saving amounted to $4500 per year or a further decrease in electric operation over steam of $.123 per 1000 ft. B. M.

The total saving in this case then may be summarized as follows:

	$ per 1000 ft. B. M.
Saving in cost of use electric over steam	$.0635
Saving in logging labor due to increased production	$.123
Total saving in cost of logs	$.1865

This is a total saving per year of $6820; more than the cost of a donkey.

The figures here given represent about the best condition that can be secured for steam operation. Another case that has been under investigation analyses as follows:

Electric yarding engine	$6,770.00
Interest 6 per cent	406.20
Maintenance 5 per cent	338.50
Depreciation 5 per cent	338.50
Taxes and Insurance 3 per cent	203.10
Total fixed charges	$1,286.30

This equipment was close to the power house so transmission line cost did not enter and power was available at the yarder for 1.3 cents per kilowatt hour and the operating cost of the electric equipment was $10.65 per day. The costs then are as follows:

Fixed charges	$1,286.30
Operation 300x10.65 =	3,195.00
Contingencies	200.00
Total cost of use of electric donkey	$4,681.30

On this basis of doing the same work as the steam this equipment will handle logs at a cost per 1000 ft. B. M. of $.213.

For steam operation we have

Steam yarder 13x13	$6,150.000
Maintenance from records	527.40
Depreciation 10 per cent	615.00
Repairs from records	146.25
Interest 6 per cent	369.00
Taxes and insurance 3 per cent	184.50
Total fixed cost	$1,842.15
Operation 300 × 21.77 =	6,521.00
Total cost of use steam donkey	$8,373.15

or a cost per 1000 ft. B.M. of $.38.

Now on a basis of the electric yarder doing 25 per cent more work than the steam, we have:

Fixed cost	$1,286.30
Contingencies	200.00
Operating costs 300x11.80 =	3,540.00
Total cost of use of electric	$5,026.30

or a fixed cost per 1000 ft. B. M. of $.1832.

Thus we have for the cost of use under various conditions assumed:

	Cost per year.	Cost 1000 ft.
Steam	$8,373.15	$.38
Electric, same work as steam	4,681.30	.213
Electric, maximum rate	5,026.30	.1832

This is a saving of $.1968 per 1000 ft. B. M. or a total saving on a year's logging over the cost of doing the same work by steam $5400, which at 6 per cent represents a capital investment of $90,000, or looking at it from a slightly different point of view it will pay for one machine in fifteen months.

Note that the $200 contingency charge was not put on the steam operation, thus giving it that much advantage.

In the saving in labor cost, due to increased production, for this camp the saving would amount to $7080 per year or a saving per 1000 ft. B. M. of $.2575.

Summarizing—	$ per 1000 ft. B. M.
Saving in cost of use electric over steam	$.1968
Saving in logging labor due to increased production	.2575
Total saving in cost of logs	.4543

This is a total per year of $12,500, more than twice the cost of a machine.

We will now investigate the influence on the situation of the more intangible factors.

Fire risk is entirely absent with the electric machine. It is difficult to value this factor but in one camp in the Northwest with the operation of which the writer has been connected, the total cost of fighting fire, not including the cost of the resulting decrease in output of the camp, was $2650, and 60 per cent of

the fires were started by the donkeys, which were using wood as fuel. It is our experience that oil burning reduces the fire hazard to about one-fourth that caused by wood burning donkey. In considering this factor each one must set a value on it based upon his own individual experience and judgment and different values will naturally be assigned by different operators.

The possibility of electric shock from the donkey is very remote and entirely negligible if all metal parts of the equipment are thoroughly grounded.

TABLE I

Operating Costs of Steam Donkeys

Company	Operation	Fuel	Fuel Cost	Operation Cost per day $	Size	Logs handled ft. B.M.	Cost M ft. B.M. $
A	Yarding	Wood	$7.00 M	34.85	14x14	80000	0.432
A	Yarding	Oil	$1.15 Bbl	16.80	14x14	82000	0.203
B	Loading	Wood	$7.00 M	19.60	13x13		
B	Loading	Oil	$1.00 Bbl	12.90	13x13		
C	Loading	Wood	$7.00 M	18.50		73000	0.254
C	Yarding	Wood	$7.00 M	19.25	11x13	67000	0.288
D	Yarding	Oil	$1.10 Bbl	14.30	14x14	76000	0.188
E	Yarding	Wood	$7.00 M	21.97	13x13	73400	0.299
F							
F	Yarding						
G	Yarding	Wood	$7.00 M	21.88	10x13	62000	0.353
G	Yarding	Oil	$1.15 Bbl	15.75	10x13	81400	0.194
G	Logging	Oil	$1.15 Bbl	17.00	11x13	96800	0.176

TABLE II

Power required by electric donkey for various operations

Work performed	Time sec.	Distance Feet	Kilowatts Max.	Kilowatts Min.	Remarks
2 logs—1900 ft. B. M.	680	840	315	147	On skids, up 5° slope
1 log—1050 ft. B. M.	360	470	240	180	Clear ground, up 10° slope
2 logs—1160 ft. B. M.	480	600	365	153	Level rough ground and brush
1 log— 740 ft. B. M.	440	590	163	84	Level clear ground
Tightening standing line 2800 ft. 1½" steel cable	10		260		
Running trolley out	40-60		100	35	
Pulling in trolley with					
1 log — 800 ft. B. M.	40		70		
4 logs—2000 ft. B. M.	65		145		Overhead System. Whitney
3 logs—1600 ft. B. M.	60		210		A. I. E. E. Sept. 1914
1 log —1100 ft. B. M.	70		85		
1 log —1800 ft. B. M.	90		95		
Loading cars	3-2		100	70	
Moving cars	3-5		225	25	

TABLE III

Operating Costs of Electric Donkeys

Company	Operation	Present steam cost Wood	Present steam cost Oil	Electric Cost		Estimated steam cost oil burning	Logs handled ft. B.M.	Cost M ft. B.M. Elec. $
E	Yarding	$21.77		$11.25		$15.60	73400	0.153
A	Yarding	$38.45		$11.65		$17.40	80000	0.146
C	Yarding	$18.50		$10.25		$12.90	73000	0.141
C	Yarding	$19.25		$11.15		$14.95	67000	0.167
G	Logging		$17.00	$13.05			96500	0.135
H	Yarding			$10.90	Test		86000	0.127
H	Yarding			$11.55	Computed		86000	0.135

The control is compact and easily operated with everything in the most convenient place for the opercreases his control over the machine, and deceases materially the liability of accidents.

The general advantages of the electric donkey have been so fully dealt with in previous papers before the Logging Congress that I will not go into them here, but there is one feature that I do wish to bring out.

An illustration is shown for connecting the donkey to the power wires. Over it will be noticed an ammeter or instrument to measure the current taken by the machine. The scale on this instrument can be made to read the pull in pounds on the cable. Protective relays are provided on this switch which can be set at a value that will disconnect the machine from the line when the strain on the cable exceeds any desired value, thus protecting the cable. Further, the operator can see at all times just what the machine is doing.

It is well known that a new cable should be handled with care the first few days it is in use, so that the strands can become properly laid and improper use is sure to shorten the life of the cable very materially. With the device shown the operator can know at all times the strain on the cable and so avoid overworking a new cable. By making this instrument recording a complete record could be kept of the use of the cable. This with a cyclometer attachment on the cable drum will give a very valuable record of the number of feet that the cable has been used over and the use or strain under which it was used each day. Incidentally this record would also show the amount and time of occurrence of the idle periods of the machine. While most logging operators will consider such information of small value, there is a growing tendency among the operators to pay particular attention to the use to which their cables are put. It is possible that by use of such an equipment cable could be purchased, as automobile tires are at present, on a guaranteed mileage basis providing it was not strained beyond a certain point during the period.

In conclusion then we see that in tanglible easily valuated costs and considering all costs, the electric donkey will handle logs at a saving over top notch oil burning steam donkeys of $.1865 per 1000 ft. B. M., and for ordinary service will show a saving of $.4543 per 1000 ft. B. M. These investigations were made for small camps and larger camps will usually show better results as the transmission line to supply one donkey will cost as much as one to supply ten, thus reducing this charge.

Many cases arise, however, wherein electric logging cannot be made to pay a reasonable return on the money invested and in such cases the only answer is Life's famous advice to young men about to be married —don't.

The success of an engineering project is always measured in terms of the earnings it secures from the money invested and it is on this basis that the decision for or against electric logging must be made. As scientific achievement there is no discussion, it can be done and done well, but as an engineering feat each project must stand or fall by itself, on the basis of the earning power of the money invested.

NEW RATES FOR ALASKAN RADIO SERVICE.

The Director of Naval Communications has announced that, effective October 1, 1916, radio rates, to conform as near as possible to the rates of the Washington-Alaska Military Cable & Telegraph system effective that date, will be placed in effect via the Naval Communication Service in Alaska. These rates will supersede all other rates in effect over this system. All traffic to or from ships at sea will be prefixed "Radio." Cable count will be used. Ten-word minimum will be required. Naval radio stations at St. Paul, St. George, Dutch Harbor, Kodiak, Cordova, and Sitka will apply a 6-cent coast tax. Service between any point in Alaska reached by the Naval Communication Service or the Washington-Alaska Military Cable & Telegraph system and any of these stations will carry a rate of 5 cents per word additional. This will also include North Head or Seattle for local delivery or for transfer to other systems to reach points beyond these systems. The traffic may be routed via either the Naval Communication Service or cable service or both. This rate does not include other line charges, which should be added if it is necessary to employ other lines to reach destination.

TESTS OF IRRIGATION PUMPING PLANTS.

BY R. H. CATES.

The following discussion gives the results of over 300 separate tests of irrigation pumping plants made by the Southern California Edison Company. The tests were made by the power engineering department of the company with methods described in the issue of the Journal for November 4, 1916.

The tests given represent what pumping plants are accomplishing under the average conditions under which they have to operate. These conditions are often variable from year to year due to fluctuations in the elevation of the ground water. This may result in the use of a pump under conditions different from those for which it was designed. It may also result in operation under excessive vacuum with its opportunities for loss in efficiency due to air leaks. It is often necessary to install a pump before the quantity which can be obtained is known so that pumps may operate at discharges different from those at which maximum efficiencies would be obtained.

In many cases the results do not represent efficiencies as high as the pumps are capable of obtaining. They do represent, however, results on which the consumers are paying the cost of pumping and therefore furnish a conservative basis for estimating the probable cost of power.

The actual efficiency of any pumping plant depends on a number of factors. It varies with the type and size of pump, the lift and the discharge. It is not possible to secure a number of field plants where only one of these factors varies. The tests given are considered to be sufficient in number, at least for several of the types and sizes, so that the resulting average efficiencies can be taken as representative of the results which are being obtained under actual field conditions. They may or may not represent what should or might be obtained, depending upon the adaptability of the plant to its conditions and the character of its maintenance.

In Table 1, the general results for all tests are given. These are classified by type and size of pump. Both the efficiency of the pump alone and of the combined motor, transmission, and pump or the overall efficiency are given. As explained in the article in the issue of November 4, 1916, the overall efficiency is the one directly determined in the test, the efficiency of the pump alone being obtained from the rated motor efficiency and an estimated belt loss of 6 per cent.

The number of tests on which each mean is based is also given. This determines the value of the resulting mean; for those sizes for which few tests have been made, the mean results should be given less weight than for the sizes and types where 10 or more tests are available.

In addition to the mean efficiency, some measure of the variations to be expected is of value. It is hardly representative, however, to pick the single maximum or minimum result for each size as the efficiency may be due to unusual conditions. It is considered, however, that the mean of the lowest one-fifth of the results should be representative of the lowest efficiency to be expected. Any lower efficiency would be due to poor judgment in construction or operation and would not be the fault of the conditions. In the same way the mean of the highest one-fifth of the results should represent the maximum efficiencies to be expected under favorable conditions. The figures for the minimum and maximum results were prepared on this basis. Where only a small number of tests were made only the mean values are given.

The mean ratio of the overall to the pump efficiency is also given. This represents the efficiency of the moter and belt where the belt connection is used. It is higher in the types where direct connection is used.

The discharges are expressed in miners' inches. The value used is one-fiftieth of a second foot, or 9 gallons per minute. This value of the miners' inch is the unit of measurement used in the territory served by this company.

The equivalent miners' inches pumped through a lift of 100 ft. per kilowatt of input were also computed. This represents the results for which payment for power is made. For 100 per cent efficiency, one kilowatt would lift 5.90 miners' inches through a height of 100 ft. The figures given can be converted into second feet lifted one foot by multiplying by two. The number of kilowatt hours required to lift one acre foot of water one foot high is given in the last column of Table 1. This unit is used in comparing irrigation pumping plant performances in many localities. For perfect efficiency 1.025 kilowatt hours are required to lift one acre foot one foot in height.

Average lift and vacuum are also given. These vary widely for the different tests comprising the mean results. They represent average conditions in the area served by the company rather than the lift for which the size of pump may be best suited.

These tests were made during 1913 to 1916. They represent plants in use during those years including many installed before 1913. In the case of some types of pumps, such as the well turbines, the plants now being installed have much higher average efficiencies than those built 2 or 3 years ago. No distinction has been made between various makes of pumps. In all the types given a number of different makes are represented.

Owing to the number of separate factors which may affect the efficiency of a pump, it is not practicable to segregate the effect of any single factor in a sufficiently large number of cases to furnish reliable averages. Certain segregations are attempted in the discussion. They are suggestive rather than conclusive, however.

In Table 2, the results of some selected tests are given. These are mainly on plants for which more than one test has been made and show the effect of different conditions. The individual conditions are given in the remarks.

In the discussion of each type of pump some comparison with the efficiencies obtained with other types are given. Such comparisons are on the basis of efficiency alone. In selecting the type of pump for any particular plant, efficiency is one of the most important factors to be considered. There are other factors, however, which need to be taken into account, such as first cost, maintenance and ease of operation, the final choice being based on all such factors.

Table 1.—Summary of Results of Tests of Irrigation Pumping Plants.

Type of Pump.	Size of Pump.	Mean Discharge in Miners' Inches.	Mean Total Lift. Feet.	Mean Vacuum. Feet.	Number of Tests.	Efficiency of Pump in Per Cent. Mean of all Tests.	Mean of Lowest 20% of Tests.	Mean of Highest 20% of Tests.	Overall Efficiency of Plant in Per Cent. Mean of all Tests.	Mean of Lowest 20% of Tests.	Mean of Highest 20% of Tests.	Ratio of Overall to Pump Efficiency.	Miners' Inches Pumped per Kw. of Input per 100 ft. Lift. Mean of all Tests.	Mean of Lowest 20% of Tests.	Mean of Highest 20% of Tests.	Kw. Hours Used to lift one acre-foot 1 ft.
Vertical Centrifugal.....	2½	10	119	7.7	2	30.	..	..	23.3	....	....	77.7	1.38	...	....	4.4
	3	17	84	19.2	9	33.0	21	44	26.6	16.8	35.6	80.6	1.57	.99	2.10	3.9
	4	50	88	18.6	28	46.8	30	60	38.1	27.9	49.0	81.4	2.25	1.65	2.89	2.7
	5	64	75	18.8	51	47.8	34	61	39.4	29.2	51.5	82.4	2.33	1.72	3.04	2.6
	6	106	83	15.4	54	54.8	39	69	45.6	31.6	58.3	83.2	2.69	1.86	3.44	2.2
	7	131	83	20.3	21	56.5	37	74	48.6	29.0	60.8	86.0	2.87	1.71	3.59	2.1
	8	241	83	17.5	9	64.4	50	76	51.6	40.5	64.4	80.0	3.05	2.39	3.81	2.0
	10	360	110	13.6	2	60.8	..	..	51.	....	....	83.9	3.01	....	....	2.0
Horizontal Centrifugal...	2	13	41	9.8	2	34.	..	..	27.4	....	....	80.0	1.62	....	....	3.7
	3	28	90	17.0	3	40.4	..	..	33.8	....	....	83.6	1.99	....	....	3.0
	3½	58	71	2.9	2	56.	..	..	47.7	....	....	85.2	2.81	....	....	2.1
	4	54	129	7.2	6	54.6	40.5	75	46.5	36.2	61.9	85.2	2.74	2.14	3.66	2.2
	5	38	45	...	1	52.5	..	..	42.2	....	....	80.4	2.49	....	....	2.4
	6	86	174	25.4	3	51.9	..	..	44.5	....	....	85.7	2.63	....	....	2.3
	7	170	44	29.4	1	54.	..	..	45.0	....	....	82.9	2.65	....	....	2.3
	8	226	131	7.1	9	60.9	43	78	53.1	38.0	71.4	87.2	3.13	2.24	4.21	1.9
	12	325	42	28.0	3	55.4	..	..	47.7	....	....	86.1	2.82	....	....	2.1
Well Turbines	10	71	134	...	5	56.0	..	..	47.3	....	....	86.2	2.93	....	....	2.2
	12	63	94	...	25	49.7	33	61	40.5	26.8	50.1	81.5	2.39	1.58	2.96	2.5
	14	80	55	...	4	39.5	..	..	32.6	....	....	82.5	1.92	....	....	3.1
	15	84	113	...	8	50.1	39	62	41.4	31.7	51.5	82.6	2.45	1.87	3.04	2.5
	16	103	47	...	2	51.8	..	..	42.8	....	....	82.6	2.53	....	....	2.4
	20	142	88	...	2	54.8	..	..	41.5	....	....	75.7	2.45	....	....	2.5
	24	115	130	...	9	55.6	38	68	46.6	31.6	58.5	83.8	2.75	1.86	3.45	2.2
Propeller	..	116	61	...	21	43.3	29	55	35.7	24.5	46.7	82.5	2.11	1.45	2.75	2.9
Piston Pump—																
Deep Well Type	..	28	189	...	7	58.9	..	..	48.0	32.	72.	81.5	2.84	1.86	4.22	2.1
Duplex	..	129	236	...	2	79.6	..	..	71.7	....	....	90.	4.23	....	....	1.4
Triplex	..	83	147	...	7	79.6	76	84	66.7	62.	73.	83.8	3.94	3.63	4.30	1.5
Air Lifts	..	42	123	...	7	27.4	10	39	23.1	8.	33.	84.3	1.36	.49	1.93	4.4

Table 2—Typical Tests of Irrigation Pumping Plants.

Type of Pump.	Size of Pump.	Total Lift. Feet.	Vacuum. Feet.	Discharge in Miners' Inches.	Efficiency of Pump.	Remarks.
Vertical Centrifugals	3	113.	31	15.2	39.4	(2-Stage pump run at same speed.
	..	127.	19	8.2	21.3	(Discharge too small for pump in second test.
	4	28.4	0	22.2	11.7	Pump found to be running backward.
	..	51.8	14	66.1	57.5	Running in correct direction.
	4	118.	28	40.5	39.5	2-Stage pump balance rings worn.
	..	120.	28	41.6	50.	Same repaired.
	5	115.5	25	54.6	36.8	2-Stage pump.
	..	105.8	15	84.	58.3	Same, year later, water level higher, larger flow.
	6	53.3	0	125.4	48.5	Runner in use for ten years.
	6	59.4	23	142.	60.	After stopping air leak.
	..	34.8	0	65.	26.9	Bad air leak, couldn't get a vacuum.
	6	62.6	16	63.3	32.6	Out of balance, runner worn.
	..	66.5	17	95.1	58.5	18 months later, refilled and new runner.
	6	66.8	23	116.	63.1	
	..	64.3	20	120.8	57.5	Same 3 years later.
	7	78.6	25	110.1	49.2	Discharge too small for this 7-inch pump.
	6	88.4	29	119.5	63.8	Replaced with 6-inch pump.
	7	34.4	29	143.	49.7	604 r.p.m. before overhauling.
	..	81.2	15	108.	49.2	690 r.p.m. before overhauling
	..	72.4	12	98.	64.5	630 r.p.m. after overhauling.
	7	41.8	16	135.	13.1	Air leak and runner plugged.
	..	50.2	18	107.	46.8	Same, runner cleaned, same air leak yet.
	8	27.5	28	294.	46.6	Low head and speed.
	.	45.8	20	282.	77.8	Same, head and speed increased.
	8	96.5	26	250.	53.6	Vacuum high.
	..	120.7	0	282.	74.5	Same, lower vacuum, higher lift.
Horizontal Centrifugal—Turbine type...	8	165.	..	209.	54.2	
	..	169.5	..	210.3	52.2	Year later.
Vertical Centrifugal	4	93.5	24	34.4	33.3	2-Stage.
	..	105.7	24	33.3	39.3	
Well Turbine—10-stage	12	102.4	..	40.6	54.4	Replaced vertical centrifugal above.
	..	107.5	..	35.2	50.7	Turbine—year later.
Air Lift	..	113.1	..	22.5	25.5	
Well Turbine—6-stage.....	12	115.7	..	31.8	54.1	Replaced air lift above.
	..	117.7	..	38.7	54.7	
	15	55.	..	115.8	40.2	2-Stage.
	..	58.	..	134.6	49.4	Same, 100 ft. of 6-inch suction pipe removed.
	20	38.6	..	156.3	42.4	4-stage—lift too low.
	..	136.6	..	127.3	67.2	
Deep Well Plunger.....	..	148.7	..	19.9	55.6	Low lift.
	..	273.3	..	19.3	61.	Same pump—high lift.
Horizontal Duplex	..	238.	..	129.5	76.8	
	..	233.	..	128.5	82.5	Same pump—6 months later, worked over.
Triplex Plunger	..	97.1	..	81.3	75.5	Low lift.
	..	229.	..	79.	78.5	Same pump—high lift.
Deep Well Plunger.....	..	194.	..	23.2	38.1	Gas in water.

LAMP SOCKET HEATING DEVICES.

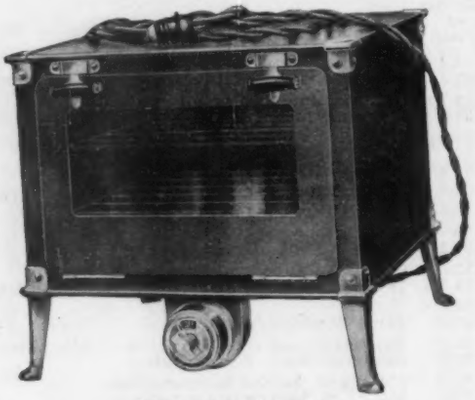
BY E. A. WILCOX.

Plate Warmers and Hot Closets.—A variety of shapes and sizes of plate warmers and hot closets are manufactured to order to fit available spaces, or standard portable types may be used.

Hughes Plate Warmer.

In estimating the size of a plate warmer closet a shelf space of at least 10½ in. should be allowed for ordinary dinner plates and a height of 6 in. for twelve in a pile.

On account of the relatively low temperature required inside the oven, the current consumption is usually low, especially if the walls are well insulated against heat losses.



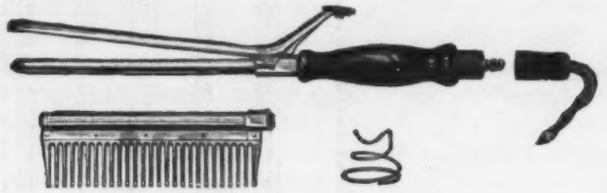
Hot Point El Bako.

Bake Ovens.—Devices like the small Hotpoint lamp socket bake ovens (El Bakos) are useful for light baking operations. The inside dimensions are 11 in. by 10½ in. by 7½ in. and they consume 600 watts on the high heat. They are of steel construction with nickel trimmings and the walls are lined with mineral wool to retain the heat. These ovens have practically all the inherent advantages of larger electric ovens.

Simplex Nursery Milk Warmer.

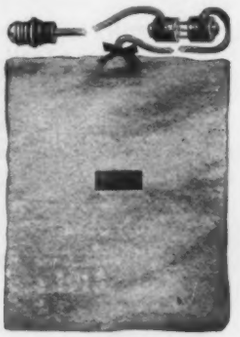
Nursery Milk Warmers.—These consist of a water vessel and cover, a milk bottle, and a nipple. They are designed for quick heating and are made in capacities varying from 300 to 500 watts. They are ready for use at any time—day or night. The 500 watt size will heat a bottle of milk in about four minutes or boil a pint of water in about six minutes.

Curling Iron Heaters.—These are desirable on account of their absolute cleanliness, convenience, and safety. They are made in capacities varying from 60 to 90 watts and in plain or ornamental types. The Westinghouse electric curling iron is equipped with a heating element inside the iron which consumes 15 watts.



Universal Curling Iron and Hair Dryer.

Warming Pads.—For local applications of heat to the body electric pads are rapidly superseding the hot water bottle and similar devices. These pads are usually made of soft padded cloth although some of the new Hotpoint pads are made of either rigid or flexible metallic materials. The Westinghouse pads are 11 in. by 15 in. and have an outer rubber cover. The Simplex pads have an eiderdown cover and are made in two sizes, 12 in. by 15 in. and 15 in. by 24 in



Simplex Warming Pad.

Hot Point Immersion Heaters.

The American warming pad is 12 in. by 13 in. Warming pads are generally provided with regulating switches giving three degrees of heat. The capacities vary according to dimensions from 50 to 100 watts maximum. The American sweating blanket is 5 ft. long by 18 in. wide and requires 800 watts.

Immersion Heaters.—These appliances are useful in the home that is not provided with a constant supply of hot water. By fastening to the lamp socket and submerging the heater in water or other liquid the substance can be brought to a boil very quickly. Inasmuch as the heating element is placed directly in the liquid the efficiency of operation is high. They are handy for shaving and similar purposes. Heaters of various shapes and capacities are available.

Other Household Devices.—A few of the better known heating and cooking devices are mentioned for reference purposes.

Egg boilers are convenient because they can be used on the table and given personal supervision.

Fry pans and saute pans designed for use on the dining room table are useful.

Soup tureens are handy for keeping soups and other prepared foods at the proper temperature for serving.

The Hotpoint utility outfit which comprises a three pound iron provided with a stand on which it may be inverted for cooking, and a receptacle for inserting a curling iron is useful for the roomer or traveler.

The foot warmer is a handy device for use in rooms with cold floors. If placed under a desk or

Universal Egg Cooker.

table it will keep an occupant warm even when the room is comparatively cold.

Air radiators of both the radiant and convection types are useful in small rooms and in cold corners. A separate chapter is, however, devoted to the subject of air heating.

The electric range campaign continues unabated. At Kalispell, Montana, forty-three electric ranges have been installed by the Kalispell division of the Northern Idaho & Montana Power Company since the start of the electric range campaign, October 15. Again, at Eureka, California, a campaign to interest housewives in electric ranges has been started by the Eureka division of the Western States Gas & Electric Company. Twenty ranges have been sold, sixteen of which will be installed in an apartment house.

SELECTED ILLUSTRATIONS IN EFFICIENCY STUDY.

BY E. L. HALL.

(The following excerpt from a paper presented by the author before the recent Pacific Coast Gas Association Convention at Santa Barbara ably illustrates methods of efficiency study in public utility problems. The author is with the Portland Gas & Coke Company.—The Editor.)

It has often been stated that no rule of thumb method is available for efficiency studies, for which reason it is easier to illustrate by example. It frequently happens that the employes have themselves, no adequate conception of the amount of work which they are capable of turning out without fatigue; the following will illustrate:

At the new plant of the Portland Gas & Coke Company there are several acres in green lawn, which being assiduously watered grew apace. The care of this lawn was entrusted to a professional gardener hired for this purpose. The writer noticed on one occasion that this man was being assisted by a helper and upon inquiring the reason was told that the gardener objected to the amount of work as being too much for one man. Now this might seem a very reasonable contention to any business man used to caring for only a small grass plot, under the diligent coaching of his spouse, and his explanation was accepted. Later on, the writer had a time study made which revealed the curious fact that a man working at a very medium rate and resting when needed could care for the lawn with the utmost ease during four days out of a week. It is equally curious that this man was apparently busy and likewise his helper, while taking nearly twice the necessary amount of time to do the same work. The conclusion to be drawn from this illustration is that no adequate conception can be had that constitutes a standard task until studies have been actually made.

A very detailed study will now be given of the manner in which efficiency control was established in the arc maintenance department of the Portland Gas & Coke Company.

At the inception of the investigation the detail cost records while kept with considerable care and interest by the arc foreman yet did not balance out with the actual expense as shown on the company's books. The first step was, therefore, to prepare such reports in an accurate and authoritative manner. This done, it was found that the actual cost per arc cleaned was nearly 5c higher per arc per month than indicated on the old report, thus showing the necessity of a close relation between the cost records and the general ledgers. The next step was to compile a detailed record for each of the employes of the department which was published monthly, at the meeting of the arc trimmers. This report contained among other information, for each employe the total number of arc calls per month and per day with the labor per arc call, material per arc call, mantles per 100 arc calls, and globes per 100 arc calls.

This publicity work together with the coaching of the men at the meetings, did a great deal towards improving results.

Meanwhile time studies were being prosecuted on the work by one of the cadet engineers, whose observations are summarized as follows:

The observer accompanied different trimmers on their routes for a period of eight days, and studied the number and sequence of operations necessary for the general maintenance work on arc lamps. After becoming familiar with the routine and operations, these were segregated into distinct operations and the time was noted for a large number of trimmers which it took to perform each operation, and the same were recapitulated, as follows:

Arc Maintenance, Tentative Standards.

		Minutes.
I	Spot ladder and box	½
II	Cleaning ceiling plate or reflector	½
III	Clean casing of arc	1
IV	Clean globe	3
V	Clean burner tips, gauze, etc	2
VI	Remove and clean Bunsen tube	3
VII	Clean chain	½
VIII	Secure signature and get out	½
	Total	11

During the investigation considerable lost motion was discovered, as a result of which the following suggestions for improvement were made:

Cleaning and drying cloth to be carried on the upper cross strap on the back of each step ladder.

Box of silica paste to be carried in hip pocket and placed on top of ladder when being used.

Pliers, and screw drivers, to be carried in hip pocket and Bunsen brush in breast pocket.

Other tools and material to be carried in case. A small screw hook should be placed on the side of the ladder near the top for holding arc nets when removed for cleaning the globe.

With this disposition of tools and equipment an arc can be completely cleaned with one trip up the ladder. In this connection the following instances of lost time and inefficient methods were noticed:

A trimmer carried his silica paste in his case, removed a globe and brought it to the ground to clean. Lost motion, here, is one trip up and down ladder and opening box once. A trimmer carried his cloth in his carrying case, and at each address it was necessary to open box and get his cloth and close box before starting up ladder. A trimmer on removing net from globe, fastened it to the chain pull of the arc while another carried the net on his head while cleaning the globe, still another trimmer carried his tools in his coat and his coat hanging on the ladder.

As a result the above standards were reduced to 7½ minutes. These time studies taken together with the known distance to be covered in getting from arc to arc, made it possible to work out a combination of cleaning time and walking time, from which scientific rates were worked out on a sliding scale basis in accordance with the number of acrs in each place and also as a means for determining the proper standards for the particular route.

An inventory was also made of the classes of establishments in which the arcs were located in order to determine the severity of usage, and from this data was compiled a correction factor to each class of business for determining the number of calls necessary above or below normal to maintain the arc in a proper operative condition. With this information at hand it became possible to considerably reduce the number of arc calls made in some places without any loss in efficiency, and indeed a portion of the saving in cleanings were given without extra charge to many places where the kind of service required more frequent attention.

As a result of all this information the average number of cleanings per arc for each month in the year, in accordance with the lighting hours, was calculated, giving also due consideration to the influence of such factors as wind and snow in the winter, flies and dust in the summer. This data was plotted on a curve and the foreman of the arc department was directed to clean all lamps in accordance with this curve, to which he should apply the proper correction factor in each place in accordance with the class of business.

The number of cleanings thus derived gave the average cost per arc per month for each month in the year, and was recorded graphically as a basis for cost control. This curve together with the actual results is illustrated below. It will be seen that the theoretical calculations were conservative and were easily realized and in fact greatly bettered. A jog in the curve will be noticed, on one month of the schedule, as a result of which the cost for that month went to pieces, but the condition was immediately rectified, showing the value of this method of operating control.

Accompanying this endeavor to reduce operating costs, all complaints were very carefully watched, and the same recapitulated in such a manner as to afford general instructions to the trimmers at their cost meetings, at the same time, a perpetual lamp to lamp inspection was inaugurated and the defects found in each lamp recapitulated according to the nature of the defect and by trimmers.

The data thus collected formed a basis of individual instructions to trimmers and resulted in a marked and immediate improvement in the quality of the work, irrespective of the fact that the costs were being reduced at the same time.

As a result of the above time studies the costs were reduced in this department in three years by 34½ per cent, while the quality of the service was considerably bettered.

DESIRABLE PROPERTIES FOR GASOLINE PURCHASES.

According to the Director of the U. S. Bureau of Mines the essentially desirable properties of gasoline may be stated briefly as follows:

(1) Neither the gasoline nor its products of combustion should have a strong or markedly disagreeable odor, this being objectionable to users of automobiles.

(2) The gasoline should be free from matter which is not hydrocarbon, such as water, sediment, acid, etc.

(3) The gasoline should be free from bodies which either originally or after combustion attack the metal composing the engine. Unremoved acid in refining, and excessive sulphur content, fall under this head.

(4) The gasoline should not contain excessive percentages of unsaturated or aromatic hydrocarbons, since some evidence is at hand which indicates that there may be limits in the ability of motors, as at present constructed and adjusted, to utilize these products.

SPARKS—CURRENT FACTS, FIGURES AND FANCY

According to estimates Russia possesses more than thirteen million unharnessed horsepower in the rapids and waterfalls of its important industrial and metallurgical districts.

* * *

In spite of the continued encroachment of electrical appliances upon the domain of gas utilization, the official statistics of the government for 1915 still show immense gains in volume and value of this product during last year.

* * *

The European war has caused a business activity in this country never before enjoyed, but at the same time there has been such a shortage of material for domestic consumption that it has been extremely difficult to keep up stocks of electrical supplies.

* * *

The fifteen million dollar bond issue just voted by the citizens of California for the perfection of their state highway system in which they have already invested eighteen million dollars should place this commonwealth among the foremost "good-roads" advocates in the world.

* * *

Professor E. C. Pickering, director of the astronomical observatory of Harvard College, brands the "daylight saving idea," by which clocks would be advanced one hour so that work would be begun earlier, as a measure of self-deception, a mere "trick to deceive the ignorant for a time."

* * *

Recent experiments of the U. S. Reclamation Service upon the effect of wind velocity on wave heights have brought out the interesting results that wind at thirty-five miles per hour produces wave heights of two feet, while a seventy-five mile per hour wind will produce a wave height of five feet.

* * *

The modification of the color tone produced by incandescent lamps has been under very serious consideration, first in the direction of the daylight lamp, with blue-tinted bulb, which gives a reasonably close approximation to white light in a very convenient and adaptable way, and at an efficiency rather better than has hitherto seemed likely.

* * *

The whole world still speculates as to what will happen after the war. Even in far off South Africa it is thought that orders for machinery and electrical appliances of all kinds are likely to assume vast proportions. The Rand is a continuous buyer of mining plant apparatus of every description, and there is no doubt that in the near future the new gold areas of the far eastern Rand will be clamoring for equipment.

* * *

An ultra-violet ray generator of an exceedingly efficient form is described in Peter Cooper Hewitt's patent No. 1,197,629. The efficiency of a vapor electric apparatus as a source of ultra-violet rays depends to a great extent on the material of which the negative electrode is composed when its vapor serves to carry the current. By employing thallium or caesium in a vapor electric apparatus, a large proportion of rays having a wave length of 2000 to 4000 microns is found to be emitted.

* * *

The electric light has again wrought another wonder. A method of printing silk fabrics by color photography presents results which appear to be interesting in the sense that the process makes possible the production on silk fabrics of decorative effects the perfection of which does not seem to have been hitherto attained by printing. The method is of course borrowed from color photography, and consists in making three successive impressions—blue, yellow, and red—from three selected photographic prepared plates. The fabric is rendered sensitive by the aid of mixtures of alkaline phenols and diazo sulphites, products which possess the property of giving coloring matters only through the influence of light.

* * *

A method for removing foreign substances from the human body with the direct aid of Roentgen rays has been devised. The new method permits the surgeon to see the field of the operation with one eye, under ordinary conditions, while the other eye sees the same field under Roentgen-ray illumination. This method of double vision is made possible by the so-called "Grashey monocle," constructed by Dr. Grashey. The Roentgen machine itself is situated below the floor, in a room under the operating room, if necessary in a cellar, and is connected by means of a speaking tube with the operating room. The surgeon is enabled to see on the picture in the Roentgen machine how far his probe is removed from the object.

* * *

The first report of the special agent sent by the U. S. Department of Commerce to the Far East to investigate foreign markets for electrical goods sets forth the fact that although American manufacturers of electrical goods are now enjoying a period of exceptional prosperity, and are manifesting a commendable willingness to enlarge the scope of their activity through the acquisition of foreign business, they are, as a matter of fact, securing only a small percentage of the export trade that should properly be theirs. To insure an adequate and firmly rooted development in the future, two things are essential: First, the American makers must base their calculations on the obvious fact that many of their present orders from abroad are the result of the great dislocation in world economics produced by the European war. Second, they must strive diligently to adapt their output to the special desires of purchasers in distant lands; they must study with care and cultivate with discretion the vast foreign markets in which their endeavors should logically be rewarded by a gratifying and permanent success.

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POWER AND GAS

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Lower Interest For Hydroelectric Developments

The cost of money is the prime factor in determining whether a proposed water-power development is feasible. The initial investment is necessarily large because reservoirs, ditches, flumes, dams, generating equipment and transmission lines are costly. Engineers agree that the irreducible minimum in these construction costs has almost been reached. So that the chief hope for cheaper hydroelectric power is in lower interest rates.

Interest rates are dependent upon the risk involved. Most water-power developments involve two elements of risk—that associated with any public utility and that associated with any uncertainty of tenure.

There is a decided tendency to assign to governmental agencies all matters of a public nature, such as the service of electric light and power to householders. This is to be accomplished through the wholesale marketing of current to municipal distributors. It is quite probable that all small concerns will be eventually served through the direct agency of the municipality. This will leave the industrial field largely to private companies. Electrochemical plants, great irrigation projects and large railway electrification offer a wide field for power supply without the complexities of public service. Private capital can be obtained for such development at a lower rate than for public utilities.

But by far the most important element in the reduction of interest rates is an assured tenure of power sites—a security utterly lacking in the present laws governing power development on the public lands and on navigable streams. The chief objection to the present regulations is their indefiniteness of tenure. As a consequence, capital hesitates to take the risk and so seeks safer channels of investment.

Two fairly suitable bills were introduced in the Senate during the last session of Congress—the Shields bill providing for developments on navigable streams and the Myers bill dealing with the public lands. The Shields bill failed to pass the House and the Myers bill is the Senate substitute for the Ferris bill as passed by the House. Both are now in the hands of a conference committee which hopes to work out measures that will be passed by both branches of Congress during the next session.

The chief point of controversy over both bills is that they provide a definite fifty-year tenure, irrevocable except for breach of conditions. Furthermore each bill provides for an indeterminate permit after the expiration of fifty years. The present laws provide that the lease be terminated without compensation to the grantee and gives Congress power to revoke the grant at any time, also without compensation. The proposed bills protect the safety of the investment by providing that the government shall pay the owners for their property at the end of the granting period or if the act is repealed or amended before that time.

Without such protection and guarantee of tenure private capital cannot be induced to undertake water-power developments, as is amply demonstrated by the present stagnation. As the necessity for development is universally admitted, there seems no sane reason for further retardation. A definite tenure is

essential to stability of investment, stability of investment is a prerequisite to low interest rates, low interest rates must prevail if cheaper hydroelectric power is to be developed. The answer is obvious.

Costs of Electric Logging

The low market price of lumber has, during recent years, forced the lumberman to study costs of production and analyze these costs to a minute degree.

This analysis early brought to light the interesting and important fact that the average cost of logging operations comprises from thirty-five to fifty per cent of the total cost of logs delivered at the mill. Since the use of the time-honored steam donkey engine enters as a large factor in this cost, an investigation of the advisability of introducing the electrically operated donkey was early initiated.

This investigation has perhaps brought to light one of the most interesting comparative studies yet encountered in winning over the steam operated load to that of the method electrical. In this comparative study a clear line of demarkation is brought to light between the electric donkey as a scientific success and its accomplishments as an engineering success. Especially is this true if we define engineering as that branch of science that enables the human being to produce two dollars where before only one was seen to blossom.

From this latter viewpoint, a discussion to be found on another page of this issue brings out the important economic conclusion that the electrical donkey will handle logs at a saving over the best oil burning steam donkeys of some eighteen and two-thirds cents per thousand feet in board measure. And, where ordinary steam donkeys are brought into the discussion this saving is found to amount to over forty-five cents per thousand feet in board measure. These investigations were carried on for small logging camps. For the larger camp the saving should be even more pronounced.

There are many other features which favor the electrical method as opposed to the steam donkey that cannot so readily be placed into this dollar and cent comparison.

The danger from fire is materially lessened, since a large percentage of losses from fire in logging camps are traceable to the steam operated donkey. On the other hand the possibility of electric shock from the electric donkey is very remote and entirely negligible if all metal parts of the equipment are thoroughly grounded.

The question of control, too, is an important one. The electric donkey is easily operated with everything in the most convenient place for the operator. This reduces the fatigue of the operator, increases his control over the machine, and decreases materially the liability of accidents. Since, then, so many additional factors favor the electric donkey as opposed to its rival, the steam donkey, it would seem that, in every instance where a reasonable saving may from investigation be found to be probable under the adoption of the electrical method, no time should be lost by the management in changing over to this modern method of logging.

Commercial Scholarships

Preston, in his well-known writings of history, calls forceful attention to three leading factors that have throughout all ages held men and nations together; namely, community of race, community of religion and community of interest. The present international war has conclusively demonstrated that the greatest of these factors is community of interest.

It must be admitted, then, that the upbuilding of commercial ties between neighboring countries which differ in race and religion largely depends upon the bond of community interest engendered by all parties to the issue.

South America and the Orient present opportunities to Western enterprise today so insignificant to what they will present on the morrow that all close observers familiar with their present gigantic proportions pause before even prophesying the possibilities of the morrow.

The question, then, is how to engender a firm and lasting community of interest with the neighbors that border the Pacific.

In England commercial scholarships are already being established to offer financial assistance to certain of her brightest and most capable young men as an inducement for them to travel and locate in a foreign country. These young men are to receive an annual stipend from the industry they represent and are to go into the foreign country with whom closer community of interest is desired and make a study of conditions there. They are to be given every assistance by the consular and diplomatic corps of the two countries concerned. They are to visit the various cities and attend courses of lectures with a strong commercial bias at universities and commercial institutions and in a hundred ways they will be enabled to acquire an intimate acquaintance with the country and with the habits and customs of the people. They will also be enabled to investigate the industries and to secure introductions to business men and to business centers. Applying this excellent example of British foresight to conditions of the West it is seen that the agricultural, industrial, engineering and commercial interests of the Pacific Coast states demand that the strongest community ties be built up between neighbors of the Pacific, especially those to the south. The time is now ripe, that chambers of commerce and other public spirited bodies should seriously consider founding similar commercial scholarships.

Let commercial scholarships be established, then, by these public spirited bodies and let our most brilliant and talented university students of the Pacific Coast compete for the honor and distinction of having a part in developing this community of interest with our neighbors of the Pacific.

The greatest commercial arena of history is to have its day upon the waters of the Pacific in the not far distant future and these young men will in after years vastly forward the wholesome community of interest that is so necessary.

PERSONALS

W. P. Hyatt, electrical contractor at Sacramento, was at San Francisco during the past week.

J. C. Hobrecht, electrical contractor of Sacramento, was at San Francisco during the past week.

B. C. Condit has resigned as chief engineer for the Northwestern Electric Company at Portland, Ore.

Jas. G. Pomeroy, manufacturers' agent of Los Angeles, was a recent business visitor at San Francisco.

A. G. Wishon, general manager of the San Joaquin Light & Power Company, was a recent visitor at San Francisco.

W. E. Sutherland, of the San Joaquin Light & Power Company, Fresno, spent a few days this week at San Francisco.

F. D. Fagan, Pacific Coast manager of the Edison Lamp Works, is making a months trip to Portland and the Northwest.

O. Laurgaard, consulting engineer at Portland, has been elected Multnomah County representative in the Oregon Legislature.

G. I. Kinney, of the General Electric Company at San Francisco, is serving as foreman of the federal grand jury at that city.

M. L. Joslyn, president of the Joslyn Manufacturing & Supply Company of Chicago, will be at Seattle for a few days next week.

N. M. Hope, formerly with the Turner Company of San Francisco, is now associated with the McFell Electric Company of San Francisco.

Hal Lauritzen, Holophane salesman with the Pacific States Electric Company, has returned from an extended business trip throughout the Northwest.

I. L. Capps, formerly with the Pacific States Electric Company, recently joined the sales force of the Studebaker Automobile Company at San Francisco.

C. G. A. Baker, vice-president and treasurer of the Baker-Joslyn Company of San Francisco, is making a two weeks' business trip in their Northwestern territory.

I. H. McCarty recently severed his connection with M. C. Baker & Son of San Francisco, to join **Louis E. Marsh** in handling The Specialty Shop of 82 Second street, San Francisco.

R. E. Fisher, commercial department of the Pacific Gas & Electric Company, has charge of the Christmas jinks to be held December 14th, for the Pacific Service Employees' Association.

W. G. Gordon, formerly with the Edison Lamp Works of the General Electric Company, has recently joined the sales force of the Pacific States Electric Company, in charge of the lamp department.

W. H. Bissell, manager of the Livermore Water & Light Company until taken over by the Pacific Gas & Electric Company, has opened a store as an electrical dealer and contractor at Livermore, California.

John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company, who was recently operated on for appendicitis, is now spending a few weeks at Redwood City. He expects to be able to be at his office shortly.

R. P. Moore, formerly assistant superintendent of the Holton Power Company, has succeeded C. E. Paris, resigned, as general superintendent of the Holton Power Company and the Holton Inter-Urban Railway Company of El Centro, California.

C. E. Heise, San Francisco district manager of the Westinghouse Electric & Manufacturing Company, is making an extended trip throughout the East, and while there will attend a Westinghouse jobbers' convention, which is to be held at Hot Springs, West Virginia.

C. E. Paris, for the past ten years general superintendent of all the public utility companies in the Imperial and Coachella Valleys, has resigned and accepted the position of manager of the Imperial Irrigation District, the largest irrigation system in the United States.

P. M. Downing, engineer in charge of maintenance and operation; **H. C. Vensano,** civil engineer, and **F. G. Baum,** consulting engineer for the Pacific Gas & Electric Company, are visiting the Halsey plant, which is nearing completion and is expected to be tied into the main system very shortly.

Paul B. McKee, assistant to the president, accompanied by **J. C. Thompson,** assistant to the secretary, of the California-Oregon Power Company, have returned to San Francisco from a trip over the entire system, and report 12 inches of snow on the tops of the Siskiyous. They also stated that construction is being started on a 7½-mile line from Hornbrook to Hilt, in Siskiyou County. They are using ⅜-inch common galvanized guy cable for their line on account of high cost of copper. The California-Oregon Power Company is now in new offices at No. 129 Leidesdorff street, San Francisco.

MEETING NOTICES.

Pacific Service N. E. L. A. Section.

The regular monthly meeting of the section was held November 14 at Ellis Hall, San Francisco, under the auspices of the electric distribution department of the Pacific Gas & Electric Company. S. V. Walton explained the purpose and plans for America's Electrical Week. S. J. Lisberger, C. A. Gaines and W. A. Hillebrand presented demonstrations and experiments illustrating the fundamental principles of electricity, showing how it is generated, how transformed, how measured and how made to perform useful work. Music was rendered by the Pacific Service Glee Club.

Los Angeles Section, A. I. E. E.

The opening meeting of the season, under the chairmanship of R. H. Manahan, was held at 6:15 p. m., November 14 at Christopher's Cafe. Following the dinner several papers covering developments of the past year in the electrical industry under the general subject, "Where Are We at Electrically?" in accordance with the following program:

"K. W. Hot and Cold," E. E. Valk Engineer General Electric Company; "Juice En Transit," Prof. R. W. Sorenson, Throop College of Technology; "Transportation," (Not Jitney), Julian Adams, Assistant Electrical Superintendent Pacific Electric Railway; "H. P. A la Motor," C. P. Walker, Engineer Westinghouse Company; "Hello Stuff," L. A. Vary, Equipment Engineer P. T. T. Company; "Candle-Power De Luxe" W. D'Arcy Ryan (He put the Lighting Rods on the Exposition), Illuminating Engineer General Electric Company; "Electrocutioner," Geo. Damon, Dean Throop College of Technology.

The officers for the ensuing year are: R. H. Manahan, chairman; Carl E. Johnson, secretary; J. M. Barker, assistant secretary; J. A. Lighthipe, Edw. Woodbury, R. A. Morehead and F. W. Harris, directors; H. A. Barre, chairman of papers committee; C. G. Pyle, chairman of entertainment committee, and Carl A. Heinze, chairman of membership committee.

Great Western Power Company Bay Section N. E. L. A.

At the regular monthly meeting held in the Commercial Club rooms, Oakland, November 13th, W. S. Leffler of the Electric Sales Service Company read an interesting paper on "Electric Water Heating," which will appear in these columns at an early date. A. H. Halloran, managing editor of the Journal of Electricity and Pacific Coast representative of the Society for Electrical Development, explained the significance

of America's Electrical Week. John Hood, local engineer with the General Electric Company, showed a movie film, "The King of the Rails," and presented facts regarding the electrification of the Chicago, Milwaukee & St. Paul Railway. This triple-barreled program entertained and instructed the members till a late hour, when refreshments were served.

San Francisco Electrical Development and Jovian League.

M. H. de Young, editor of the San Francisco Chronicle, was the guest of honor at the League luncheon on November 8th. Geo. C. Holberton, as chairman of the day, delegated Fred Myrtle to introduce Mr. de Young. Mr. Myrtle stated that Mr. de Young's hobby was Golden Gate Park and that he would speak specifically regarding the Memorial Museum. In a most interesting address Mr. de Young then recounted his early experiences as a collector and the gradual growth of the remarkable collections in the museum. He exhibited the plans for the new museum which he is to build in the park. N. J. Prendergast, chairman of the entertainment committee provided high class entertainment for the occasion by Violet and Ruth Sebastian, graceful dancers, and by Harold Jacobs, who proved his art as a magician.

The Bi-Monthly Luncheon of the Portland A. I. E. E., N.E.L.A. and the Oregon Society of Engineers.

The regular luncheon in the orange room of the Oregon Hotel on Wednesday, November 8, 1916, was under the auspices of the Oregon Society of Engineers. Mr. W. S. Turner, president of the Oregon Society of Engineers, presided as chairman. The first speaker of the day was Mr. Fred F. Henshaw of the N. S. G. S., who spoke on "Hydrometric Work in Oregon." The other speaker of the day was Mr. N. G. Pike, president of the Portland Rotary Club and he spoke on the subject of "Unity of Purpose." Mr. Pike made a strong plea for the universal brotherhood of men, especially in their various local organizations. The individuals should get closer together and have more charity for the other fellow's faults and failures.

Fifty-nine members were present at the meeting.

Los Angeles Jovian Electric League.

"Trade Conditions in South America" was the subject of an interesting address given before the League at their regular weekly luncheon Wednesday, November 8th, by Seward C. Simons, secretary of the Municipal League of Los Angeles. He stated that due to the interruption of the European war, we are getting a portion of the large potential trade of South America, and answering the question as to why we have not had this business in the past, made the following comments:

"We have not realized that we must know a people and its characteristics, before we can build up a friendship, and we must build up friendship before we can build up trade.

"We must know the language of the country, Spanish, for all the nations, except Brazil and Uruguay, which speak Portuguese. Foreign trade must be on a reciprocal basis. Up to the present time, Argentine and other South American countries, have been producing the same articles of commerce as the United States. They had nothing to trade with. Trade follows capital. At the opening of the present war, England had $1,000,000,000 in Argentine Republic, alone; the United States, $5,000,000. It is hard for an American salesman to 'land' an order from the British directorate. We had practically no ships of our own; 60 per cent of the vessels leaving Buenos Ayres, were British. Whereas, the English merchant was willing to buy anything and everything which the South American had to sell, the American only sought a single product, such as grain or beef. While foreign merchants had banking assistance, we have only just now established branch banks. We have been unwilling to take the time and patience to win the regard of the Spanish-American peoples. We have disregarded instructions as to packing, shipping and preparing articles for export. We have forgotten that the South American is sensitive, proud of his nation, resents our attitude of superiority, and fears our national ambitions."

UTILITIES CONFERENCE IN WASHINGTON.

Practically every electric and power company and every large city in the state of Washington were represented at the electric conference, which was given over to the consideration of proposed changes in electric, gas and water rules.

Representatives of electrical workers introduced at the conference held this week relative to the proposed revision of electric, gas and water rules by the public service commission, a set of amendments to the overhead construction rules, all of them being designed to make overhead construction safer. No definite action was taken by the commission, for, owing to a misunderstanding other representatives before the commission had not prepared any proposed changes in overhead construction rules, but had come prepared only to discuss the tentative general rules governing service. The general rules were informally discussed, after which the commission adjourned to meet in Seattle December 5th for further consideration of the problems.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

Although the commission finds that the Western States Gas & Electric Company does not earn in its Eureka division 6 per cent on its gas and electric properties, it has determined, after a discussion with the company officials, that the only thing to do is to reduce the rates instead of raising them. The commission says the problem which the company seeks to solve cannot be solved by increasing its rates, "as such increase could not be justified by the worth of the service to the consumer, and if attempted would probably decrease the company's gross revenue. The only solution is an attractive rate to customers and the reduction of electric production expenses." An order establishing a schedule of reduced rates has been issued by the commission.

The Pacific Gas & Electric Company has presented its application for authority to use $2,250,000 derived out of the proceeds of the sale of stocks and bonds authorized by the commission last January. The money is to be used for extensions, additions and betterments in the various departments of its system. The largest part, or about $1,850,000, is for construction of its hydroelectric plant on the South Yuba River. The balance is for miscellaneous improvements. The company reported that up to September 1st it had sold of the authorized securities all of the bonds and 9939 shares of stock at an average price of $91.62 per share, amounting to $910 697.50. On the South Yuba plant $818,535 has been spent, and $1,031,464.19 is to be spent.

The Southern California Edison Company has petitioned the commission for an order determining that the commission's findings as to the just compensation to be paid by the city of Los Angeles for the company's plant in that city shall no longer be of any force. On September 6th the commission fixed the compensation to be paid to the Southern California Edison Company for its distribution system sought to be taken under eminent domain proceedings at $6,328,000. The petition says that the city of Los Angeles has taken no steps to act upon the decision of the commission and that more than sixty days have elapsed since its filing. Therefore, the petition says, the city, having failed to comply with the public utilities act, the commission's order finding the amount to be paid should be declared void. The company vigorously opposed the finding of the commission, asserting that the proper price to pay for its properties was at least $20,000,000.

NEWS NOTES

INCORPORATIONS.

NORTH YAKIMA, WASH.—The Union Land & Power Company has filed articles of incorporation. Capital $100,000, by M. Velikanje, M. A. Freidlin, G. D. Foster, F. E. Moxley and W. D. McNair.

RENO, NEV.—Articles of incorporation have been filed by the Patterson Water Company, a new land and irrigation corporation, with a capital stock of $10,000, divided into 10,000 shares at a par value of $1 each; headquarters are at 230 N. Virginia street. W. H. Patterson of Cedarville, Cal., and Robert Richards and S. Summerfield of Reno, are the incorporators and directors.

BUTTE, MONT.—Articles of incorporation have been filed by the Intermountain Power Company. The object of the corporation is to develop water power in Montana and other states, and to sell the power so developed. The principal office is to be in Butte and the life of the corporation is fixed at 40 years. The capital stock is $500,000 in 5000 shares of $100 each. The incorporators are C. F. Kelley, Charles J. Kelly, John Gillie, L. O. Evans and Eugene Carroll. Directors of the new company stated that plans are not in shape for a more detailed announcement of the plans and prospects of the concern. The location of the power sites was not announced

ILLUMINATION.

POPUAR, MONT.—This place has voted bonds to the extent of $6500 for the construction of a municipal lighting plant.

POCATELLO, IDAHO.—The Pocatello Electric Company was awarded the contract for the work in lighting district No. 20, including light posts and other equipment, at $51,513.73.

WHITTIER, CAL.—A resolution ordering the installation of lighting posts along Philadelphia street, has been adopted by the city council.

CLE ELUM, WASH.—South Cle Elum has let the contract for its new electric lighting system to C. H. E. Williams of Seattle, whose bid was $4070.

NORDHOFF, CAL.—Arrangements have been made for lighting the streets of the business section of the town by the Ojai Valley Mine League.

KINGMAN, ARIZ.—The Wallapai Light & Power Company has been refused a certificate of convenience and necessity to operate an electric plant in the town of Chloride.

BOISE, IDAHO.—Bids are being received by the city clerk for the construction of a lighting system in local lighting district No. 2, according to plans on file with the city engineer.

SAN PEDRO, CAL.—Bids for the electric installations for Shed 152 have been received by the board of harbor commissioners. The J. M. Mullins Company was the lowest bidder at $2315.

LOS ANGELES, CAL.—Sealed bids will be received by the board of supervisors up to November 27, for furnishing lighting fixtures for the hall of records, in accordance with plans and specifications on file in the office of the board.

CALEXICO, CAL.—The Imperial Valley Gas Company is planning to establish a plant here in the near future. It is probable that the company will lay gas mains in alleys here and have them completed before the proposed paving is put down.

LOS ANGELES, CAL.—The city council has passed an ordinance calling for the installation of the necessary appliances and electric current to be furnished for one year for lighting of Hobart boulevard between Washington street and Adams street.

CHLORIDE, ARIZ.—The Desert Power Company has made an offer to furnish street lights for Chloride. The rate asked for ten 250 watt street lamps placed along Tennessee avenue with a couple of small lights on Second, is $2.50 per month per lamp. It is probable that sufficient funds will be raised for the purpose.

PORTLAND, ORE.—The board of county commissioners has awarded the lighting contracts on the interstate bridge as follows: Lamp posts and brackets, Pacific States Electric Company, $1538; wiring and copper conductors, U. S. Steel Products Company, $8472.40; transformers and time switches, Pacific States Electric Company, $1714.32.

CENTRALIA, WASH.—At a recent meeting, the stockholders of the Centralia and Chehalis Gas Company, the properties of which were taken over a year ago by the North Pacific Public Service Company, voted to dissolve the corporation. In accordance with this action, a petition was filed in the Pierce County Superior Court by W. W. Seymour, president.

TELEPHONE AND TELEGRAPH.

STANWOOD, WASH.—An ordinance has been passed granting a franchise to the People's Telephone Company.

SEDRO WOOLLEY, WASH.—The Skagit Valley Telephone Company has asked for a 50 year franchise in this city.

OKANOGAN, WASH.—According to C. C. Crandall, the Pacific Telephone & Telegraph Company will make further improvements to its system in Okanogan county.

STANWOOD, WASH.—Stanwood has granted a franchise to the Peoples Telephone Company to construct lines for the transmission of electricity and for telephone purposes.

HILLSBOROUGH, CAL.—The Pacific Telephone & Telegraph Company has been granted permission to erect a building at the intersection of Floribunda avenue and the State Highway.

NENANA, ALASKA.—The United States government is requesting bids for the construction of a signal corps station at this place. Plans and specifications are on file at Fairbanks telegraph office.

BURNS, ORE.—It has been suggested that steps be taken to connect this place with Bend by telephone. The cost would be about $12,000. J. E. Weston, manager Intermountain Telephone & Telegraph Company at this place, made the suggestion to the Commercial Club of Bend.

OAKDALE, CAL.—Announcement has been made of a number of extensive improvements by the telephone company. Included in the improvements is the construction of a new trunk line from Oakdale to Modesto. Cost of the construction is given at $10,000.

HONOLULU, T. H.—The Marconi Wireless Telegraph Company has announced that it is ready to inaugurate regular wireless service between here and Japan. Company officials declare this the longest wireless commercial service ever operated. It will enable San Francisco to transact business by wireless with Japan, relaying messages here.

TRANSMISSION.

COLFAX, WASH.—The Commercial Club has taken up the question of securing a heating plant for the city.

VALLEJO, CAL.—The Pacific Gas & Electric Company has applied for permission to install a cable across Mare Island straits.

REDDING, CAL.—The Northern-California Power Company has a crew extending its line from Lewiston to Weaverville, a distance of eight miles.

TACOMA, WASH.—The Tacoma District Heating Company expects to be at work in 30 days laying pipes in the district by Ninth and Thirteenth streets.

ANACORTES, WASH.—The city council recently passed a resolution inviting the Puget Sound Traction, Light & Power Company to extend its light and power lines to this place.

TACOMA, WASH.—The Tacoma District Heating Company contemplates having in operation by January 1st a 1040 h.p. steam heating plant for furnishing heat to business and office buildings.

PENTICTON. B. C.—The purchase of 12 5 ampere watt hour meters has been authorized by the council, also 2 10 ampere watt hour meters. The purchase of a Diesel engine to cost about $25,000, is also being considered.

SEATTLE, WASH.—An ordinance has been introduced in the city council providing for the condemnation of land and other property for a steam electric power plant site along side of the present plant on the east shore of Lake Union.

COLTON, CAL.—The Fontana Power Company has commenced construction of a 36 in. concrete pipe line to convey water from the plant soon to be erected to the Fontana tract. Contracts have also been closed for the purchase of the steel pipe line for carrying water four and one-half miles from the mouth of the canyon to the plant. For the plant proper 300 additional tons of steel will be necessary. The plant will have a capacity of 1800 kilowatts or about 2400 h.p.

TRANSPORTATION.

EUREKA, CAL.—The Humboldt Transit Company will voluntarily forfeit its franchise for operating electric cars on T street.

SACRAMENTO, CAL.—A large force of men has been put to work on Twenty-fourth street by the Pacific Gas & Electric Company preparatory to laying double tracks.

HONOLULU, T. H.—The board of directors of the Honolulu Rapid Transit Company has authorized the construction of a new two-mile line from Liliha street, along School street to Kalihi Road and the sale of $400,000 stock to the present stockholders to cover other minor extensions.

PRESTON, IDAHO.—According to C. G. Haynes of Blackfoot the project of the Pocatello Traction & Interurban Company to build an electric road north from here to the Yellowstone is assured.

SEATTLE, WASH.—The city council and the Seattle & Rainier Valley Railway Company have reached an agreement whereby the company will upon being relieved of certain franchise obligations spend $10,000 in improvements resulting in a gain of ten minutes in time of running between Seattle and Renton.

IRRIGATION.

EVERETT, WASH.—D. R. Keys and C. R. Riddle filed notice of appropriation of water in Glacier Creek.

COUER d'ALENE, IDAHO.—The county surveyor, Neil S. Coventry, is aiding in the formation of a drainage district near St. Joe.

TERRA BELLA, CAL.—Six water bearing strata have been encountered by the rotary well rig in the employ of the Terra Bella irrigation district.

MEDFORD, ORE.—The petition for the irrigation district in the Foots Creek district will be heard by the commissioners on November 9. It will embrace about 1200 acres.

MALTA, MONT.—Booth & Krips, of Saco, Mont., have the contract for the construction of structures on the Nelson River reservoir, South Canal Milk River project at $28,384.

WOODLAND, CAL.—W. L. Wales has been awarded a contract to build an irrigation system for the Honey Lake Valley Irrigation District in Lassen county. The district embraces 33,000 acres.

PRINEVILLE, ORE.—The electors of the Ochoco irrigation district will vote November 11 on the proposed issue of $1,000,000 in bonds for the construction of a dam six miles above here on the Ochoco, sufficient to irrigate 23,000 acres of land.

AUBURN, CAL.—The Pacific Gas & Electric Company is filing actions against several people with whom it has been unable to reach satisfactory agreements as to rights of way for the ditches and tunnel it was ordered to build in order to supply water for irrigation around Newcastle.

SEQUIN, WASH.—The bond election recently held here resulted in the Happy Valley Irrigation District authorizing bonds to the extent of $80,000. The district will proceed with the construction of an irrigation canal from Dungenness River to cover 6000 acres of land just south of here.

SUSANVILLE, CAL.—Leon Bly of San Francisco has made application to the United States Land Office here for right of way for a ditch from Eagle Lake. Mr. Bly proposes to appropriate 30,000 acre feet of the waters of that lake for the irrigation of in the neighborhood of 20,000 acres of land in Honey Lake Valley.

SANTA BARBARA, CAL.—For the purpose of irrigating the Hart tract in Montecito, which has been recently purchased by Mrs. C. B. Raymond, a million gallon reservoir is being erected, work being done under the direction of F. F. Flournoy, a six-inch main is being laid from Romers canyon to carry the water to the reservoir.

MARYSVILLE, CAL.—The Farm Land & Investment Company has applied to the state water commission for permission to appropriate 100 cubic feet per second of the waters of the Yuba and Feather rivers for the culture of rice. The proposed diversion is to be by means of centrifugal pumps, electrically driven. There are 5500 acres to be watered and ahe estimated cost of the system is $31,000.

EL CENTRO, CAL.—It has been suggested that $15,000,000 be raised for improvement work in Imperial Irrigation District, to be expended as follows: $3,000 000 for building Laguna dam, $3,000,000 to pay off the irrigation district bonded indebtedness, $2,000,000 in building the canal and connecting up with Laguna dam, $2,000,000, for electric and water power plants and distributing lines, $2,000,000 in building main canals and distributory canal system.

SACRAMENTO, CAL.—Preliminary steps have been taken for the establishment of a Wright irrigation district for Fair Oaks and vicinity. Petitions have been circulated and the necessary number of acres secured. The number of acres to be irrigated is 3600 and it is estimated that the entire cost of the new system will be $125,000. The property owners are divided in the opinion as to the advisability of buying the old pipes and system or building a new one throughout. The petition will be presented to the supervisors at the December meeting.

DIXON, CAL.—Engineer Hawley has pronounced the reservoir sites of Devil's Gate, Guenoc and Devil's Head as feasible sites and the watershed ample for the irrigation of 55,000 acres by development of two of the three sites. J. H. Peterson, local rancher, favored further consultation with the Yolo Water & Power Company, with a view to getting canals run into northern Solano county, and favored a gravity system district if the present land holders would be benefited. W. J. Weland urged still further investigation and pleaded for consideration of a proposition he believes will greatly develop the latent possibilities of the land of this part of the county.

ALPHABETICAL INDEX TO ADVERTISERS

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Los Angeles; 755 Folsom St., San Francisco; Seattle.

B-1 Baker-Joslyn Company 2
71 New Montgomery St., San Francisco; 911 Western Ave., Seattle; 353 E. Second St., Los Angeles.

I-1 Benjamin Electric Manufacturing Co.....
590 Howard St., San Francisco.

C-1 Century Electric Co..... 3
906 So. Hope St., Los Angeles; 56 Natoma St., San Francisco; 65 Front St., Portland, Ore.

C-3 Crocker-Wheeler Co.....
87 New Montgomery St., San Francisco; 228 Central Avenue, Los Angeles.

C-4 Cutler-Hammer Manufacturing Co.....
579 Howard St., San Francisco; Morgan Bldg., Portland, Ore.; San Fernando Bldg., Los Angeles.

D-4 Davis Slate & Manufacturing Co.....
Chicago, Ill.

D-2 Dearborn Chemical Company..... 11
355 East Second St., Los Angeles; 301 Front St., San Francisco.

E-1 Edison Lamp Works of General Electric Co.....
Rialto Bldg., San Francisco; 724 So. Spring St., Los Angeles.

E-2 Edison Storage Battery Co..... 11
206-8-10 First St., (near Howard), San Francisco.

E-3 Electric Agencies Co.....
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E-4 Electric Storage Battery Co.....
743 Rialto Bldg., San Francisco.

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E-6 Electric Novelty Works.....
533 Mission St., San Francisco.

E-7 Economy Fuse & Mfg. Co.....
Kinzie and Orleans Sts., Chicago.

F-3 Federal Sign System (Electric).....
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G-1 General Electric Co..... 10
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T-1 Thomas & Co., R.....
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T-2 Tubular Woven Fabric Company.....
Pawtucket, R. I.

U-1 United Sheet Metal Works.....
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W-1 Wagner Electric Manufacturing Company..... 3
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W-2 Western Electric Co..... 5
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W-3 Ward-Leonard Electric Co..... 12
Mt. Vernon, New York.

W-4 Westinghouse Electric & Manufacturing Co..... 6
50-52 East Broadway, Butte; Van Nuys Bldg., Los Angeles; Couch Bldg., Portland; 212 So. W. Temple, Salt Lake City; First National Bank Bldg., San Francisco; Second and Cherry Sts., Seattle; Paulsen Bldg., Spokane.

W-6 Westinghouse Lamp Co.....
(See Westinghouse Electric & Manufacturing Co.)

W-8 Western Pipe & Steel Co.....
444 Market St., San Francisco; 1758 North Broadway, Los Angeles.